PB85-249506

Superfund Enforcement Decision Document (EPA Region 5): Chem-Dyne, Hamilton, Ohio July 1985

(U.S.) Environmental Protection Agency
Washington, DC

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EPA

Superfund Enforcement Decision Document:

Chem-Dyne, OH

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

The Chem-Dyne site is located within the limits of the City of Hamilton, Butler County, Ohio, which has an estimated 1980 population of 66,400. The site covers approximately 10 acres of land, and lies within the bedrock aquifer of the Great Miami River. The Chem-Dyne site probably began receiving hazardous substances as early as 1974. Additionally, Spray-Dyne, one of the numerous Chem-Dyne "affiliated companies", produced anti-freeze on site, by "recycling" chemical wastes and by using virgin chemicals. By 1976, Chem-Dyne was a rapidly growing corporation storing, "recycling", and disposing of almost every type of industrial chemical waste. Operations of Chem-Dyne resulted in uncontrolled releases of hazardous materials. In five years of operation the facility accepted waste from approximately 200 generators. The materials handled included pesticides and pesticide residues, chlorinated hydrocarbons, solvents, waste oils, plastics and resins, PBBs, PCBs, TRIS, acids and caustics, heavy metal and cyanide sludges, and packaged laboratory chemicals. More than 30,000 drums and 300,000 gallons of bulk materials were left on site when the operation closed in February 1980.

The selected remedial action includes: installation of a ground water extraction system with subsequent treatment of the contaminated water (air emissions from the treatment system shall be treated by carbon adsorption); demoliton of onsite buildings; (continued on separate sheet)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. D.S. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Record of Decision Chem-Dyne, OH Contaminated Media: soil, gw, sw, air Key contaminants: priority pollutant acid compounds, volatile organic compounds, arsenic, chlordane, dieldrin, benzo(a)pyrene, hexachlorobenzene and PCBs.		

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Continued

removal of selected soil; and installation of a site cap. Total capital cost for the selected remedial alternative is estimated to be $11,600,000 and O&M costs are estimated to be an additional $597,000 per year.

Enforcement Decision Document
Remedial Alternative Selection

SITE: Chem-Dyne, Hamilton, Ohio

DOCUMENTS REVIEWED

I am basing my decision on the following documents describing the analysis of the cost and effectiveness of remedial alternatives for the Chem-Dyne Site.

- Chem-Dyne Remedial Investigation
- Chem-Dyne Feasibility Study
- Responsiveness Summary
- Proposed Consent Decree
- Remedial Action Plan (Attached to the Proposed Consent Decree)

DESCRIPTION OF SELECTED REMEDY

The selected remedy consists of the following elements:

1) A groundwater extraction system with subsequent treatment of the contaminated water. Air emissions from the treatment system shall be treated by carbon adsorption.

2) Building demolition, selected soil removal with the installation of a site cap. The cap would be constructed in accordance with RCRA.

3) Performance objectives of the remedy are described in the Remedial Action Plan.

DECLARATIONS

Consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and the National Contingency Plan (40 CFR

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Part 300), I have determined that this remedy at the Chem-Dyne Site is a cost-effective remedy that provides adequate protection of public health, welfare and the environment. The State of Ohio has been consulted and agrees with the approved remedy. In addition, the action will require future operation and maintenance activities to ensure the continued effectiveness of the remedy. These activities will be considered part of the approved action. Settlements have been reached between EPA, the State and the responsible parties based on the selected remedy.

I have also determined that the action being taken is a cost-effective alternative when compared to the other remedial options reviewed.

JUL 5 1985

DATE

Assistant Administrator
Office of Solid Waste and Emergency Response

Attachments:

Summary of Remedial Aternative Selection
Community Relations Responsiveness Summary
Consent Decree
Remedial Action Plan

Summary of Remedial Alternative Selection

Chem-Dyne Hamilton, Ohio

Site Location and Description:

The Chem-Dyne site is located within the limits of the City of Hamilton, Butler County, Ohio, which had an estimated 1980 population of 66,400. The site covers approximately 10 acres of land on several parcels of property on the northern border of the city (see figure 1-2).

The site is bounded immediately on the south by a residential district. Farther to the south are the business district and additional residential districts. It is bounded on the east by a municipal park whose facilities include six ballparks and a municipal swimming pool. Residential dwellings lie to the east of the park. The site is bounded on the north by the Ford Hydraulic Canal, which flows west to the Great Miami River. Immediately north of the canal is an agricultural field. Approximately 1,500 feet north of the site is one of Hamilton's two water treatment plants, which pumps groundwater from deep wells during the summer months. The site is bordered on the west by a railroad right-of-way. Next to this railroad right of way is the Ransohoff Company, a sheet metal fabrication plant. Also to the west is the City of Hamilton Power Plant. Approximately 75 yards from the site are coal piles and a large petroleum storage tank for the City of Hamilton power plant. Farther to the west are warehouses for the Champion Paper Company, and a small residential area.

At the start of initial remedial activities in May 1983, there were approximately 8,600 drums, 30 tanks, and 2 open-top belowgrade tanks onsite, all containing hazardous wastes. The tanks and drums contained an estimated 463,000 gallons of fluid, 109,000 gallons of sludge, and 86,000 gallons of solids. Drums were generally in a badly deteriorated condition; many were leaking or open. Additionally, two below grade truck loading docks, one gravel lined, were used as hazardous waste mixing vats. They were full of hazardous liquids and sludges, and their drains were not compeltely sealed.

Other onsite equipment included two tanker trucks (5,000 gallons), four semitruck trailers, two flat beds, an empty fuel type tank (300 gallons), one outdoor reaction vessel (100 gallons), six reaction vessels (4,700 gallons each), and miscellaneous debris inside the Chem-Dyne building.

There are five major buildings on the Chem-Dyne site. (see figure 1-4).

- Chem-Dyne building
- Boiler building
- Ward Manufacturing building
- Ford building (formerly a Ford tractor factory)
- A blue warehouse (prefabricated)

Former operations by Chem-Dyne centered around the Chem-Dyne building. The Chem-Dyne building housed the Chem-Dyne offices, blending tanks, and other equipment; it is presently in a dilapidated state. Three nearby buildings, the boiler building, Ward Manufacturing building, and Ford building, are also dilapidated. There is evidence to indicate that they were used by the Chem-Dyne Corporation. A detailed inspection of the buildings found occasional drums and evidence of hazardous waste draining into the basement of the boiler building. The blue warehouse and the parking lot to the south of the blue warehouse were also used by the Chem-Dyne Corporation to store drummed waste, and there are signs of drum leakage in the blue warehouse building and on the parking lot to the south of the blue warehouse.

Site History:

The Chem-Dyne site probably began receiving hazardous substances as early as 1974. Additionally, Spray-Dyne, one of the numerous Chem-Dyne "affiliated companies," produced anti-freeze, on site, by "recycling" chemical wastes and by using virgin chemicals. By 1976, Chem-Dyne was a rapidly growing corporation storing, "recycling," and desposing of almost every type of industrial chemical waste. Chem-Dyne produced and sold chemical fuels by mixing chemical wastes in bulk storage tanks, open containers, and gravel lined "loading docks." Other wastes were "stored" in drums and tanks, including at least one old leaking railroad tank car, in buildings and outside on the ground. The Chem-Dyne facility ceased "operating" in February of 1980.

In 5 years of operation the facility accepted waste from approximately 200 generators. The materials handled included pesticides and pesticide residues, chlorinated hydrocarbons, solvents, waste oils, plastics and resins, PBB's, PCB's, TRIS, acids and caustics, heavy metal and cyanide sludges, and packaged laboratory chemicals. More than 30,000 drums and 300,000 gallons of bulk materials were onsite when the operations were closed.

Operations of Chem-Dyne resulted in uncontrolled releases of hazardous materials. Mixing of liquid wastes was often done in open gravel lined pits, releasing noxious vapors into the atmosphere, and contaminating soil and ground water. Reportedly, 55-gallon drums were punctured with pickaxes and were allowed to leak, or were dumped onto the ground or into a trough or pit. Tank cars were reportedly emptied onto the ground, and into troughs and sewers. Fifty-five gallon drums were frequently stored 3 or 4 high, and due to compression, corrosion and internal pressure allowed their contents to escape into the environment. Deposition testimony indicates that wastes were frequently spilled and that at one time a large pool of waste, referred to as lake ergancx covered one portion of the site surface.

In over 5 years of operation, a number of environmental incidents were reported at the Chem-Dyne facility. From 1976 to 1979, there were at least five fish kills in the Great Miami River that were attributed to Chem-Dyne operations. One fish kill stretched for nearly 37 miles from the Ford Hydraulic Canal to the mouth of the Great Miami River. In 1976, a series of fires and a fuming railroad tank car incident, created by the improper mixing of chemical wastes, generated active public concern and media coverage.

Another series of fires occurred in 1979. In addition, continuous odor complaints were received by local and State authorities from local residents during certain periods of operations of the site.

Legal actions arising out of Chem-Dyne Corporation's handling of waste material began shortly after Chem-Dyne began handling hazardous waste. In June 1976 Chem-Dyne filed a $30 million suit against the City of Hamilton and its officials for harassment. On September 29, 1976, the State of Ohio filed a suit against Chem-Dyne and the affiliated Chem-Dyne corporations. The suit alleged that the companies were responsible for killing more than a million fish and water animals in the Great Miami River and for emitting offensive odors into the air. The suit sought compensatory and punitive damages totalling $340,000 and called for a permanent end to illegal discharges into Ohio waters and abatement of air pollution nuisances. Both suits were settled on July 19, 1979, whereby Chem-Dyne agreed to prevent future pollution and to remove all inventory (waste material) within 12 months. Chem-Dyne also agreed to drop its suit against the City of Hamilton and to pay $75,000 in fines. Chem-Dyne did not comply with the terms of settlement, and in fact increased the amount of hazardous waste on site.

The U.S. EPA filed suit against Chem-Dyne, pursuant to the provisions of RCRA, on December 19, 1979. Two days later, the City of Hamilton and the Ransohoff Corporation joined in the federal suit against Chem-Dyne. The suit sought to force Chem-Dyne to stop operations, remove wastes from the site, and clean up any soil or groundwater contamination.

On January 24, 1980, the Ohio Attorney General filed a motion in the state court requesting that a receiver be named to assume operations at Chem-Dyne. The state court appointed Jack Zettler, a Hamilton lawyer and accountant, as receiver on February 4, 1980. The state subsequently requested that the Federal court obstain from proceedings in the U.S. action and defer to the State court . The State represented that the the receiver would adequately respond to the problems at the Chem-Dyne site. The U.S. then requested and received a dismissal without prejudice of its filed action. The receivership, however, removed only 20,000 drums of waste from the site before running low on funds, and effectively stopped operating in 1981.

In October of 1981, the Chem-Dyne site was included on U.S. EPA's Interim Priority List and in December of 1981 was designated the State of Ohio's top priority Superfund site. In March of 1982, U.S. EPA expended $50,000 on an Immediate Removal of waste from a leaking bulk storage tank, and plugging some of the storm drains on the site.

In March of 1982, an action memorandum was signed by U.S. EPA Headquarters, allocating $3.4 million for surface cleanup and a Remedial Investigation and Feasibility Study.

Additionally, during 1982 and early 1983, the U.S. EPA and the State of Ohio contacted a number of generators of waste materials, who had readily identifiable waste left at the site, and requested that they voluntary remove their wastes from the site.

On August 26, 1982, U.S. EPA and the State reached an agreement with over 100 potentially responsible parties (PRP's) for the partial funding of the removal of contaminated waste from the site and for the RI/FS. More specifically, the PRP's agreed to contribute an amount, 2.4 million, which was in excess of their estimated proportionate share ("fair share or volumetric share") of the estimated costs of the surface contaminated waste removal and the conducting of an RI/FS. In the Auugst 26, 1982 agreement, the U.S. specificially reserved the right to take any action and to seek to recover costs for any action taken in response to the soil and ground-water contamination at the site.

Simultaneously, the U.S. filed a suit to recover additional costs from certain owners, operators, transporters, and generators of hazardous waste (PRP's) who declined to participate in the August 26, 1982, partial settlement. The law suit was subsequently amended to address soil and ground water contamination, and to add several additional PRP's, some of whom participated as defendants in the August 26, 1982 settlement. The State of Ohio filed a similar suit in Federal court on September 14, 1982, and the State and Federal actions were consolidated into a single proceeding on November 4, 1982.

The surface cleanup of some 8,600 drums and 33 bulk waste storage tanks, through an Interagency Agreement with the U.S. Army Corps of Engineers, took place from May of 1983 to December of 1983. The majority of the liquid and flammable waste was transported to a high temperature incineration facility in Eldorado, Arkansas while most of the solid and semi-solid waste was disposed of at the CECOS chemical secure landfill in Williamsburg, Ohio. The total costs of the surface cleanup, cleanup plan and inspection amounted to over $3.4 million.

All containerized surface waste has now been removed from the site. A remedial investigation conducted by U.S. EPA's remedial contractor, CH2M Hill, Inc., has documented remaining contamination to buildings, soils and the ground water at the site. The Final Remedial Investigation Report (RI) was released by U.S. EPA on May 22, 1984. On November 19, 1984, U.S. EPA released the Feasibility Study (FS) Report for the Chem-Dyne Site. The FS, submitted herewith, analyzed the RI data to assess the health and environmental risks posed by contamination at the site and evaluated a number of remedial alternatives for cleanup at the site in accordance with the National Contingency Plan published July 16, 1982 (40 CFR 300.68). Public comments on the FS were received until December 28, 1984, and are included as part of the Responsiveness Summary, also submitted with this document.

Current Site Status:

The Remedial Investigation at the Chem-Dyne site included analysis of the soils, ground water, nearby surface waters, and on site facilities. Analysis of onsite soil samples taken from borings, test pits, and the surface has indicated extensive contamination consisting of priority pollutant acid compounds, and volatile organic compounds (VOC's). Several of these contaminants are considered carcinogenic and their presence in soils at the site

is considered a human health threat due to direct contact and carry over by site intruders, air transport of volatiles and particulates, and the leaching of compounds into the groundwater and buried conduits onsite. The quantities of inorganics, base/neutrals, and pesticide contaminants have been found to be concentrated in the upper 3 feet of soil at the site, while the majority of VOC's range in the upper 6 feet of the soil horizon. The Endangerment Assessment (see FS) conducted for on-site soils, assuming no action, direct contact with soils and additive effects (no effects of synergism) of chemicals, determined that exposure to the site soil could lead to an excess lifetime cancer risk of 0.05, using the maximum chemical concentrations found in the top 15 feet of soil, or 4×10^{-4} for the mean concentrations of the top one foot of soil. Of the 31 known or suspected human carcinogens found on the site, the concentrations in soils of arsenic, chlordane, dieldrin, benzo (a) pyrene, hexachlorobenzene and PCB's would be the major contributors to this increased cancer risk. Some of these compounds were found to be widely dispersed over the site, while others, such as PCB's, were found only in certain areas of the site.

The Chem-Dyne site lies within the bedrock valley aquifer of the Great Miami River. The geologic materials underlying the Chem-Dyne site are a highly variable mixture of sands, gravels, silts and clays deposited by glacial melt waters from receding continental ice sheets. Interglacial streams and rivers cut deeply into the bedrock of the area and, as the ice receded and the flows lessened, deposited the materials that now make up the aquifer. The aquifer generally follows the course of the Great Miami River. It is approximately 2 miles wide and is bounded on both sides by steep walls of bedrock. Its thickness is generally around 150 to 200 feet. Because of the variable nature of stream deposition, the aquifer materials are highly variable as well. Coarse gravels and cables could be found in some areas while silt to silty clay lenses could be present in others. The water table in the vicinity of the site is at a depth of 25 to 30 feet with seasonal and river-induced fluctuations. Also lying within the Great Miami River valley aquifer are a number of industrial production wells (See figure 17) and well fields used by the City of Hamilton for drinking water. Production wells in the area are typically 100 to 150 feet deep, producing 500 gallons per minute (gpm) or more from the deeper parts of the aquifer. The City of Hamilton north well field is upgradient from the site and would apparently not be threatened by a groundwater contaminant plume emanating from the site. However, the city's south well field along with a number of other water sources are located downgradient from the site (Reference to MCD Table 11), and could be threatened by a ground water contamination plume emanating from the site. The variable nature of the aquifer, the close proximity of the Great Miami River and the Ford Hydraulic, as well as the location of several production wells presents an extremely complex hydrologic environment.

As part of the Remedial Investigation, a hydrogeological investigation was conducted at the site that included installation of 36 monitor wells near the site, and a hydraulic aquifer pump test. This investigation has been supplemented by other investigations which have included installation and sampling of additional monitor wells, monitor well level measurements and permeability tests, and groundwater modeling. Analysis of data from the pump test and

groundwater samples from the monitor wells indicate that a contaminant plume consisting primarily of VOC's is present near the site and has the potential for affecting groundwater receptors in the near future (See figures 36 and 38). The RI report estimated the range for groundwater velocities in the vicinity of the site as being between 0.5 ft per day to 1.5 ft per day. The report also indicated that groundwater flow direction is from east to west beneath the site with a change in direction to a southerly flow with the course of the Great Miami River. The report, however, also stated that groundwater flow is being influenced by the Champion Paper Company wells on the west side of the river and that portions of the plume could migrate westward and downward beneath the river. It appears, therefore, that contaminants from the plume could be taken in by a number of industrial production wells located within a 1-mile radius of the site, presenting near term exposures due to volatilization of contaminants within these industrial facilities from the use of contaminated water. The city's south well field is located east of the river and would be in the path of the southerly component of plume migration, resulting in long term exposures due to contamination of the drinking water supply.

Assuming both migration of the plume and leachate from contaminated soils, the endangerment assessment in the FS estimated that contaminants in the water at both the Hamilton south well field and a well installed in the future near the site, if used for drinking purposes, would present an excess lifetime cancer risk of about 9×10^{-5} and 2×10^{-4}, respectively (See Table 2-7 in FS).

Sampling and observations during the RI have also indicated extensive contamination of some of the facilities (utilities and buildings) on site. This type of contamination presents a future source of contamination to soils and groundwater, and poses a health threat from direct contact and air exposure.

Finally, sampling of fish, sediments, and water in the Great Miami River, and a tributary, the Ford Canal, did not indicate significant contamination attributable to the Chem-Dyne site.

Alternatives Evaluation:

The Feasibility Study followed a step-by-step procedure to develope, assess, screen, and evaulate remedial action technologies and alternatives which could address problems identified in the RI of the Chem-Dyne site. The goals of the step-by-step procedure were to reduce the range of alternatives to the most suitable remedial actions, and to document this decision process.

Assessment of applicable remedial action technologies (FS Chapter 3) was based on the following criteria: first, technical feasibility; second, environmental, public health, and institutional effects; and third, estimated present worth costs. Remedial technologies were assessed by these criteria independently, without considering possible advantages or disadvantages of applying such technologies in combinations.

Following assessment of individual remedial action technologies, "assembled" remedial action alternatives were screened using the same criteria as applied to the technologies (FS Chapter 4). An example of an assembled remedial action alternative for groundwater is the following: groundwater extraction with air stripping treatment and discharge to the Ford Canal. In this example, three technologies are combined or assembled into a single alternative.

Finally, selected assembled remedial action alternatives were analyzed (FS Chapter 6) based on detailed consideration of the criteria applied to the remedial action technologies, with particular emphasis on technical performance and estimated present worth costs.

The objectives of the remedial action alternatives and the various remedial action technologies evaluated for those alternatives are as follows:

I. Offsite Remedial Actions [40 CFR 300.68(e)(3)]:

To effectively prevent the further migration of and to remove and treat the groundwater contamination plume emanating from the Chem-Dyne site. This plume, consisting primarily of volatile organic compounds (VOC's), is the result of leaking and spilled wastes from Chem-Dyne operations. Removing the contaminants from the aquifer will help protect existing industrial production wells in the vicinity of the Chem-Dyne site, and the City of Hamilton south well field.

Remedial action technologies evaluated in the FS to accomplish this objective were: the use of groundwater extraction wells with treatment of extracted groundwater by air stripping, and treatment of off gases by vapor phase carbon. The extracted and treated ground water could either be discharged to the Ford Canal, deep well injected into a deep aquifer, or reinjected into the shallow aquifer.

Implementation of the deep well injection technology is unfavorable due to: concerns about possible negative impacts of UIC; institutional constraint such as the position of the State of Ohio that if PRP's are doing the work then PRP's must obtain an underground injection control (UIC) permit from the State of Ohio (which would likely create delays as its very time consuming); and negative public comments received on this technology.

Treating extracted groundwater by air stripping volatiles to different degrees, and discharging the treated water to the Ford Canal was evaluated and costs estimated in the FS. The discharge to the Ford Canal would take into account National Pollution Discharge Elimination System (NPDES) requirements, and if the work is conducted by the PRP's the

state has asserted that the State will require PRP's to obtain a State of Ohio issued NPDES permit. Reinjection of the extracted treated ground water into the shallow aquifer in order to increase gradients to extraction wells was a technology which was evaluated in the Remedial Action Plan.

II. Source Control Remedial Actions [40 CFR 300.68(e)(2)]:

To prevent contact with or migration of contaminated soils at the Chem-Dyne site. Also, a number of contaminated and dilapidated buildings on the site present a threat to the health and safety of persons entering the site. In addition, contaminants from the soils and buildings are leaching into the ground-water, thereby adding to the contaminant plume.

Remedial action technologies evaluated in the FS to meet this objective were: partial removal of contaminated soils and buildings, and covering the site with a cap to prevent contact with and leaching of the remaining contaminants. Contaminated soils and structures removed from the site would be transported to a hazardous waste facility permitted to accept such materials. Any site cap would conform to the Part 264 technical standards of RCRA. In addition, the FS evaluated a perimeter cut-off trench around the site which would seal any utilities at the site which may be a conduit for off site migration of contaminants.

Detailed analysis of these objectives and alternatives in the FS yielded four remedial action alternatives which represent a reasonable range of responses to the endangerment at Chem-Dyne, and which are consistent with the National Contingency Plan. To summarize the remedial action alternatives, four tables were presented in the Feasibility Study. These tables present outline descriptions of the alternatives and the estimated costs. The "no-action" alternative was also considered in the Feasibility Study.

Community Relations:

The Chem-Dyne Feasibility Study was released to the public on November 19, 1984. The release of the FS was followed by a five (5) week public comment period which ended on December 28, 1984. A public meeting was held by the U.S. EPA at the Hamilton City Hall on December 3, 1984, and was attended by over 100 citizens from the area. A number of comments were received from the general public and from the Chem-Dyne defendant steering committee during the public comment period. These comments and the response of the U.S. EPA to these comments are presented in the Responsiveness Summary submitted with this document.

Following issuance of this document, and upon settlement achieved pursuant to a signed Consent Decree, this document, the Responsiveness Summary, the Consent Decree, and all associated cleanup plans will be released to the public for review and comment. In addition, U.S. EPA, in conjunction with the State of Ohio, will continue community relations activities such as technical updates, public meetings, etc., throughout the design, construction and remediation phases of the cleanup. Additional information on community relations can be found in the Final Community Relations Plan dated January 25, 1984.

Consistency With Other Environmental Laws:

It is recommended that the technical aspects of the remedial action alternatives implemented at the Chem-Dyne site be consistent with other applicable environmental laws. Other environmental laws which appear to be applicable to the remedial action alternatives evaluated in the Feasibility Study are the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Clean Air Act, the Safe Drinking Water Act, and the Toxic Substances Control Act (TSCA).

The provisions of RCRA applicable to remediation at Chem-Dyne would be the 40 CFR Part 264 technical standards for the placement of a cover system or cap on the site, and the 40 CFR Part 264 Subpart F Groundwater Protection standards. The partial soil removal and capping alternatives evaluated in the FS are analogous to those actions which would be taken during "closure" of a RCRA facility. RCRA would require that contaminated soil either be removed to background (or other standard protective of human health and environment), or that the soils be capped on site.

The Groundwater Protection Standards under RCRA Part 264 will apply to the level of groundwater cleanup achieved by the extraction well system. An alternate concentration limit (ACL) will be established at the waste management unit boundary, (at the Chem-Dyne site, this will most probably be the property boundary) and will consider the factors outlined under 40 CFR 264.94, including impacts on nearby surface water bodies. It is recommended, however, that the ACL demonstration at the Chem-Dyne site be deferred until the conclusion of the remedial action program outlined in the Consent Decree. Deferring the ACL demonstration will allow EPA, the State, and the defendants to collect additional information during the course of remedial actions, and refine the fate and transport models which will be used to determine the effects on potential receptors of any remaining contamination within the plume at the conclusion of the remedial action program. In fact, given the uncertainty of contaminant behavior in ground water, it was the opinion of EPA experts that no meaningful concentration limit could be established at this time. To ensure that the extraction system is effectively controlling the spread of contamination during this interim period, monitoring points will be established down-gradient from the site and beyond the influence of the outermost groundwater extraction wells.

At these compliance monitoring points south and southwest of the site, groundwater quality must not exceed background levels or 10^{-6} incremental cancer risk criteria at any time during the operation of remedial actions or thereafter until it is demonstrated that the ground water protection standards have not been exceeded for five consecutive years. Local institutional controls, such as aquifer use restrictions and well-drilling bans will be established during the period of remedial action for all areas where groundwater quality exceeds background conditions.

Any discharge of extracted ground water to the Ford Canal should be in compliance with National Pollution Discharge Elimination System (NPDES) requirements. The effluent limitations will include limits on VOC's, selected metals, acids, base/neutrals, and pesticide priority pollutants. The treatment technology to be used to meet the effluent limitations is air stripping.

Air stripping the volatile organic compounds would transfer the VOC's into the discharged gas, and would require consideration of the substantive requirements to install and operate the air stripper as a new emission source under the Clean Air Act. State of Ohio air pollution regulations require the air stripper to comply with "best available treatment" (BAT), which is defined by the State as the maximum emission control achievable by the source taking into account environmental, energy, and economic considerations. For these reasons, off-gas scrubbing by carbon adsorption was included in the remedial action alternatives evaluated in the FS, and is part of the proposed remedy.

If extracted ground water is reinjected to the aquifer, Underground Injection Control (UIC) substantive requirements must be considered. The reinjection plan proposed in the RAP is not subject to Section 405 of the new RCRA Hazardous and Solid Waste Amendments of 1984. Section 405 amends Section 7010 of RCRA, and bans injection of hazardous waste, except under certain circumstances. The circumstances present at Chem-Dyne exempt the reinjection system from a ban under RCRA.

Provisions of the Toxic Substances Control Act (TSCA) would apply to cleanup and disposal of soils contaminated with PCB's at the site.

Recommended Alternative:

Assembled Alternative No. 4 in the Feasibility Study was used as a basis for negotiations with the PRP's. This alternative is the lowest cost alternative which is technologically feasible and reliable, and which effectively mitigates and minimizes damage to and provides adequate protection of public health, welfare and the environment at the Chem-Dyne site. The remedy described below is consistent with that alternative, and it is recommended that this remedy be implemented at the Chem-Dyne site. As described above, this remedy complies with the NCP and other applicable environmental laws. This remedy, to be implemented pursuant to the proposed Consent Decree, is summarized below:

Description Of The Proposed Remedy

I. Off-Site Remedial Actions

(i) Ground Water Extraction/Reinjection System

This system will differ from the ground water extraction system described in the FS in that a number of extraction wells will be pumping throughout the identified contaminant plume, and a portion of the extracted ground water, after treatment, will be reinjected into the shallow-zone of the aquifer. The reinjection of treated water will occur at reinjection wells placed within clusters of extraction wells in an effort to increase gradients to the extraction wells in order to purge and reduce contaminants (specifically VOC's) in the aquifer.

This system will have to meet the same standards for groundwater cleanup as those systems described in the FS. The outermost extraction wells of the system will be placed at the boundary of the identified 100ppb total VOC contour contaminant plume. The extraction/reinjection system will be required to establish and maintain an inward hydraulic gradient, both vertically and horizontally, to ensure that contaminants within the plume boundary are contained for removal and treatment. Compliance wells to the south and southwest of the system shall be monitored to ensure that the system is operating effectively. Groundwater quality at these wells shall not exceed background conditions as determined by 40 CFR 264.97 or any water quality criteria for the protection of human health (based on 10^{-6} health risk).

These standards will provide necessary protection of groundwater receptors, both industrial and drinking water, to the south and southwest of the site. The groundwater extraction system will be operated for a minimum of 10 years, and thereafter as needed to reduce the contamination in each monitoring well within the plume boundary to less than 100ppb total VOC's and until settling defendants demonstrate that concentrations of total VOC's have become "effectively constant" in each monitoring well within the plume boundary. This demonstration must be made through a rigorous statistical procedure set forth in the settlement documents. If concentrations can be shown to be "effectively constant", it will mean that further operation of the extraction system will not result in any improvement of groundwater quality. It is important to note that this demonstration is the controlling factor in terminating the system. When concentrations of contaminants have become effectively constant, fate and transport modeling will be conducted, using data collected throughout the remedial action program, to predict the effects of any remaining contamination on potential receptors. At that time, an ACL demonstration may be made following the procedures set forth in 40CFR 264.94. Additional detailed criteria for monitoring, contingency mechanisms and shutoff of the systems are in section V of the proposed Consent Decree. An illustration from the proposed Remedial Action Plan of the extraction/reinjection system is attached as Figure 7. This system, involving reinjection into the aquifer, will meet Underground Injection Control (UIC) requirements.

(ii). Groundwater Treatment System

Prior to reinjection or surface discharge of the extracted ground water, the water will be treated to meet the requirements of the UIC and NPDES programs administered by the State of Ohio. The extracted ground water will be pumped to an air stripping system for VOC removal. The design goal for the air stripping system shall be to remove at least 95% of the peak concentration of total priority pollutant VOC's influent to the system. This level of treatment is estimated to meet Water Quality Standards for human consumption criteria at 10^{-6} health risk level in the Ford Canal.

Vapor phase activated carbon shall be provided to remove contamination from the off gases in the air stripping system. The emissions from the air stripping system must meet the limits applicable under Federal and State law.

Contingencies shall be developed and implemented in the event of either of the following:

(a) Existing treatment processes are determined to be insufficient to allow the discharged effluent to meet permit limitations.

(b) The groundwater treatment system is demonstrated to be a source of nuisance ordors.

A proposed schematic of this system from the Remedial Action Plan is attached as Figure 10.

II. Source Control Remedies

(i) Building Demolition and Selected Soil Removal with Site Cap.

Observable waste materials remaining within the on-site structures shall be removed, provided that such removal is cost effective and is to a site approved by U.S. EPA and OEPA. Asbestos waste shall be disposed of at a site approved for disposal of asbestos. The structures themselves shall be demolished with portions either being salvaged, removed for disposal off-site, or left on-site as contour material for the cap (as specified in the Consent Decree). Prior to demolition, the buildings on-site will be investigated by the settling defendants and any portions found to be contaminated will be de-contaminated or removed for disposal off-site at a U.S. EPA approved facility.

Excavation and removal of contaminated soils has recently been undertaken by the defendants. These actions focused on removal of soils contaminated with PCB's, and disposal occurred off-site at U.S. EPA approved sites.

The site shall be covered with a cap consisting of the following composite construction; a 24 inch layer of clay soil (with a maximum coefficient of permability of 10^{-7} cm/sec.); a permable sand zone; a synthetic liner; and a sand, loam, and topsoil root zone for vegetative cover. The cap shall be graded to promote run-off and to minimize soil losses due to erosion.

Monitoring and long term maintenance of the cap are essential to proper remediation. Detailed monitoring, maintenance and contingency provisions are contained in the proposed Consent Decree.

An illustration of the composite cap construction from the Remedial Action Plan is attached as Figure 11.

III. Operation and Maintenance:

The groundwater extraction and reinjection system shall be operated for a minimum of 10 years by the Settling Parties to the Consent Decree. The groundwater treatment system will be operated as necessary to meet the terms and conditions of the NPDES and UIC programs administered by the State of Ohio. During operation of the groundwater extraction/reinjection system, water level measurements will be taken to ensure that both vertical and horizontal inward hydraulic gradients to the system are maintained. Compliance monitoring wells and monitoring wells within the system will be sampled with chemical analysis for VOC's and other compounds to monitor the effectiveness of the system operation and remediation. Maintenance and replacement of components of the groundwater extraction, treatment and reinjection system will be undertaken by the Settling Parties as necessary.

Additional monitoring of the Ford Canal will be performed in accordance with the requirements of the NPDES. Oversight of the system operation performed by the Settling Parties will be undertaken by the U.S. EPA, the U.S. Army Corps of Engineers, and the Ohio EPA. Local institutional controls restricting aquifer uses in areas where groundwater quality exceeds background conditions will be established by the State of Ohio.

Operation of the groundwater extraction/reinjection system may be terminated after 10 years and an ACL demonstration may be made if both of the following performance goals, governing ground water at the site and within the 100ppb total VOC plume boundary, are met:

(a) A concentration of not more than 100ppb total priority pollutant VOC's in each monitoring and extraction well within the defined 100ppb total VOC plume boundary.

(b) The concentration of total priority pollutant VOC's has become effectively constant in each monitoring and extraction well within the defined 100ppb total VOC plume boundary.

If after 20 years of operation of the groundwater extraction/reinjection system, both performance goals are still not met, a determination will be made as to whether further operation and modification of the system would be cost effective. If the U.S., the State of Ohio, and the Settling Defendants to the Consent Decree agree that further operation would not be cost-effective and an ACL demonstration may be made, the system may be terminated. If the parties disagree, the matter may be subject to judicial decision. During the time in which any such decision is pending before the Court, the settling defendants will continue to operate the system.

The settling defendants must maintain the integrity of the site cap until such time that they can demonstrate that the cap is no longer needed to maintain groundwater standards, or until they can demonstrate to U.S. EPA and the State that another entity is willing and able to continue such maintenance.

The Chem-Dyne PRP's are willing to undertake and complete the remedial alternative set out in this EDD. The specifics of the proposed settlement with the Chem-Dyne PRP's, other than the remedial alternative set out in this EDD, are not discussed in this document because the proposed settlement considerations do not lend weight to or impact the selection of the remedial alternative set out in this EDD. The appropriateness of the remedial alternative set out herein is to be reviewed on the basis of this EDD, the attachments hereto, CERCLA, the NCP and U.S. EPA policy. If the remedial alternative set out herein is unacceptable, the proposed settlement will be reconsidered accordingly.

This EDD has been reviewed by the legal and technical staffs of U.S. EPA Region V and Headquarters, and by the U.S. Department of Justice.

SCHEDULE

June 1985	Enforcement Decision Document. Consent Decree. Public Comment. Permit Approvals.
September 1985	Access Agreements and Easements Obtained.
September 1985	Installation of Plume Definition, Extraction and Injection Wells.
October 1985	Building Demolition and Utilities Rehabilitation/ Abandonment.
March 1986	Completion of Additional Data Collection and Plume Definition Report.
March-September 1986	Construction of Site Cap
July 1986	Installation of Off-Site Extraction and Injection Wells
July-August 1986	Construction of Groundwater Treatment Plant.
September 1986	Start-Up of Groundwater Extraction, Treatment and Re-injection System.
1986-1996	Operation, Maintenance and Monitoring of Groundwater Extraction, Treatment and Re-injection System
1996-2006	Further O&M of Groundwater System, if necesary
2006	Further maintenance of site cap as necessary.

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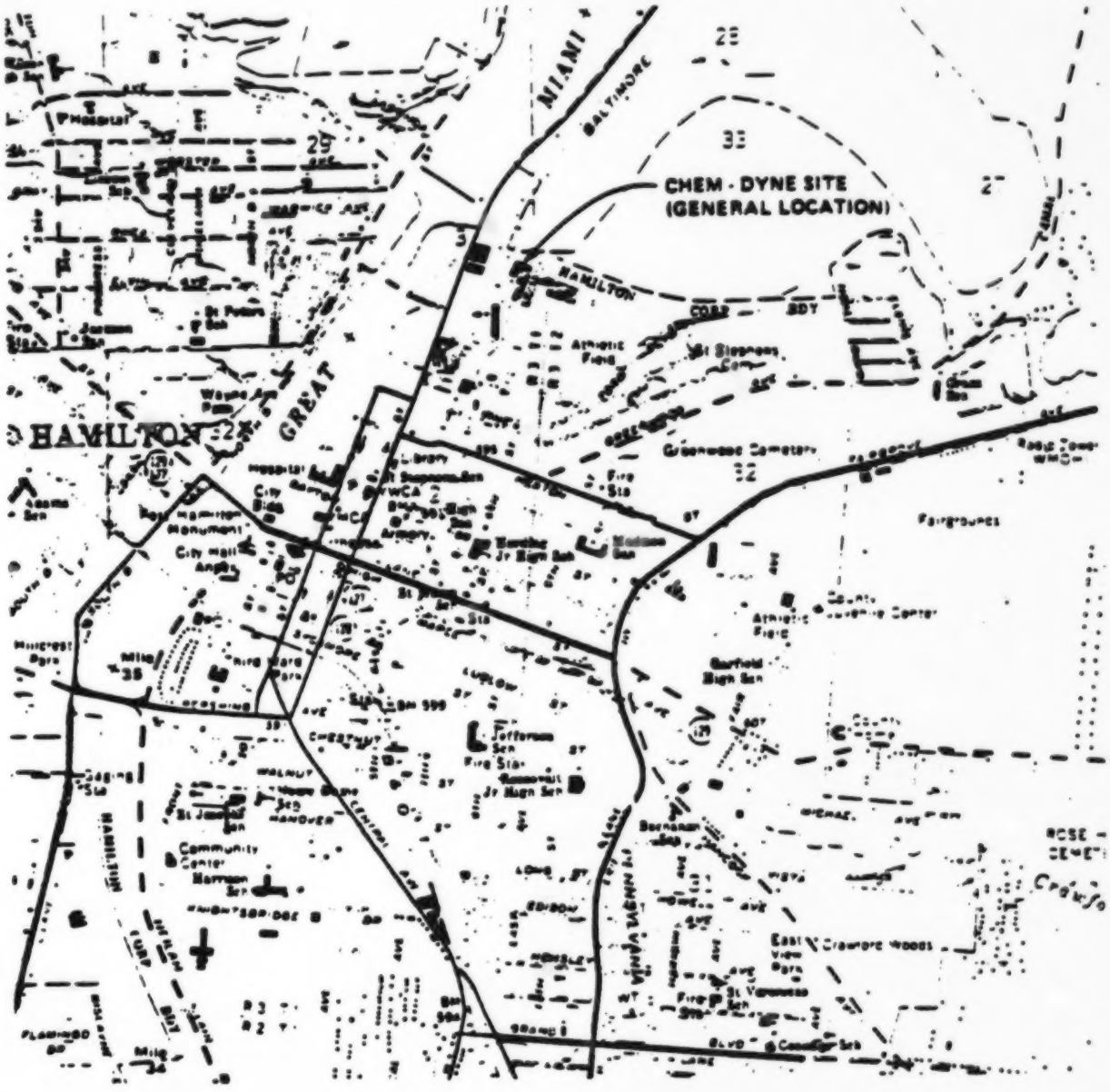

FIGURE 1-2
LOCATION MAP
CHEM - DYNE FS

SOURCE: USGS Hamilton, Ohio 1974.

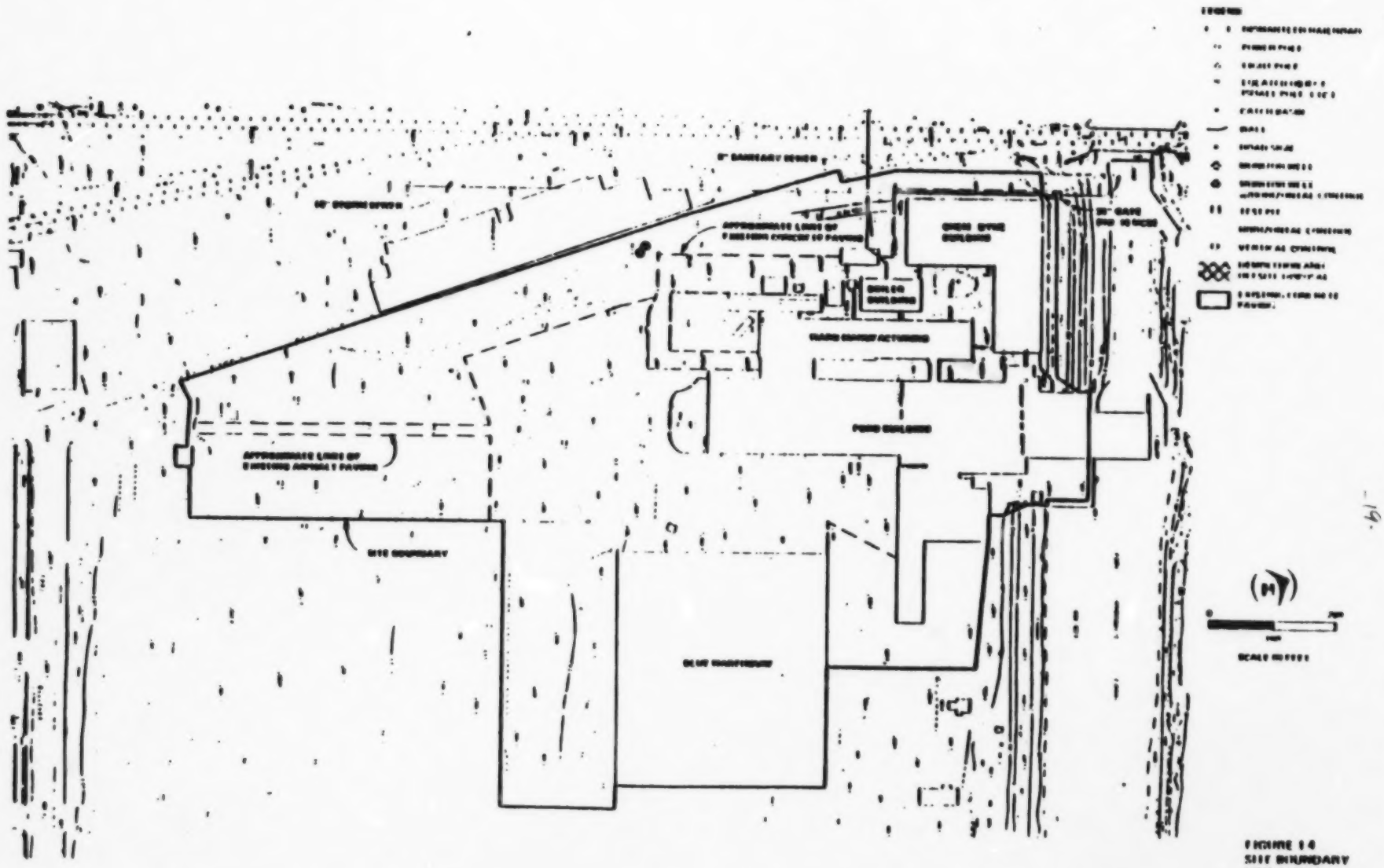

FIGURE 1-2
SITE BOUNDARY

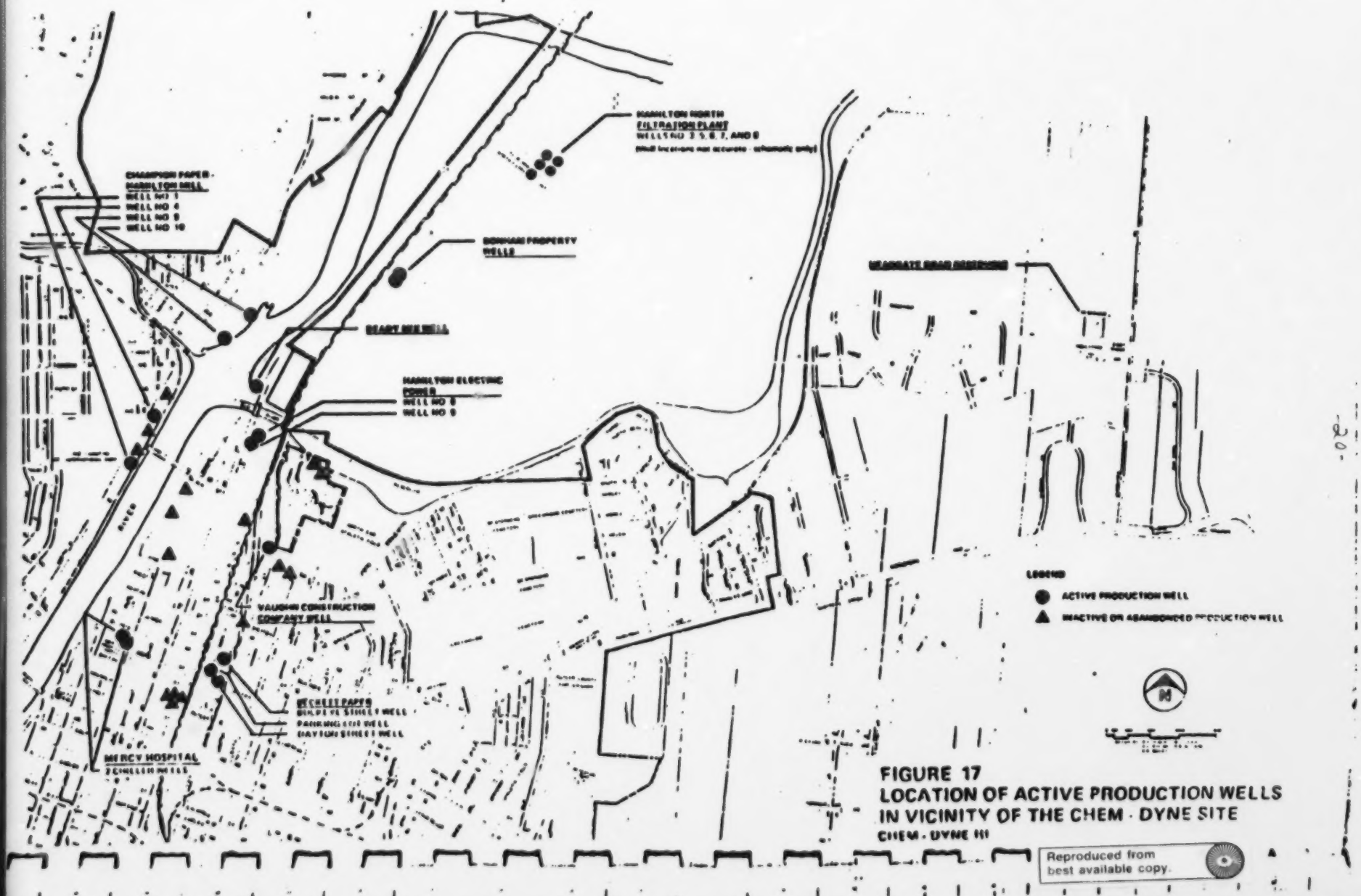

FIGURE 17
LOCATION OF ACTIVE PRODUCTION WELLS
IN VICINITY OF THE CHEM · DYNE SITE
CHEM · DYNE III

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The Water Conservation Subdistrict
of The Miami Conservancy District

TABLE 11

MAJOR WATER USERS
HAMILTON-NEW BALTIMORE AREA

NAME of WATER USER	TYPE of WATER SUPPLY	NUMBER of PEOPLE SERVED
POTABLE WATER		
1. CINCINNATI BOLTON PLANT	MUNICIPAL	760,000*
2. HAMILTON SOUTH	MUNICIPAL	80,000**
3. FAIRFIELD	MUNICIPAL	33,000
4. NATIONAL LEAD	NON-COMMUNITY	800
5. WATER ASSOCIATION	PUBLIC	20,900
NONPOTABLE WATER		
6. SOUTHWESTERN OHIO WATER COMPANY	INDUSTRIAL	13 Industries
7. FISHER BODY	INDUSTRIAL	1 Factory

* includes people served from Ohio River water plant(approx.90%)
** includes people served from Hamilton North Plant

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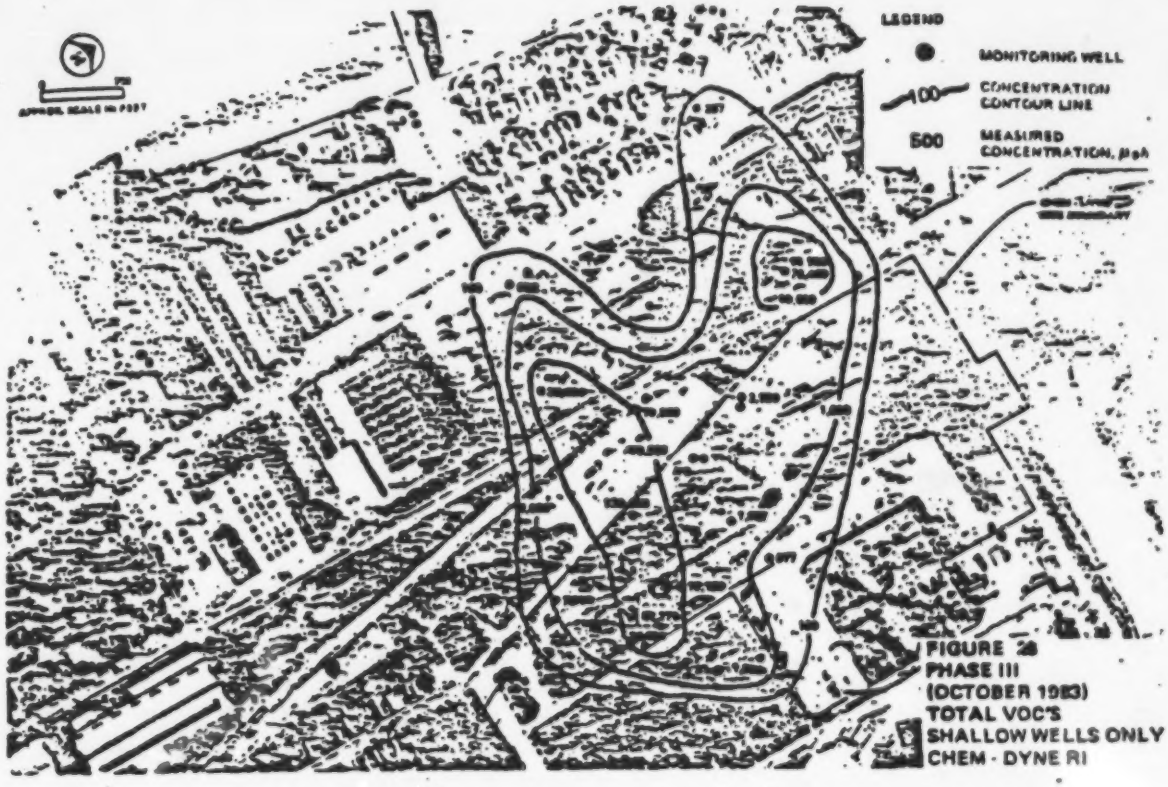

FIGURE 2B
PHASE III
(OCTOBER 1983)
TOTAL VOC'S
SHALLOW WELLS ONLY
CHEM - DYNE RI

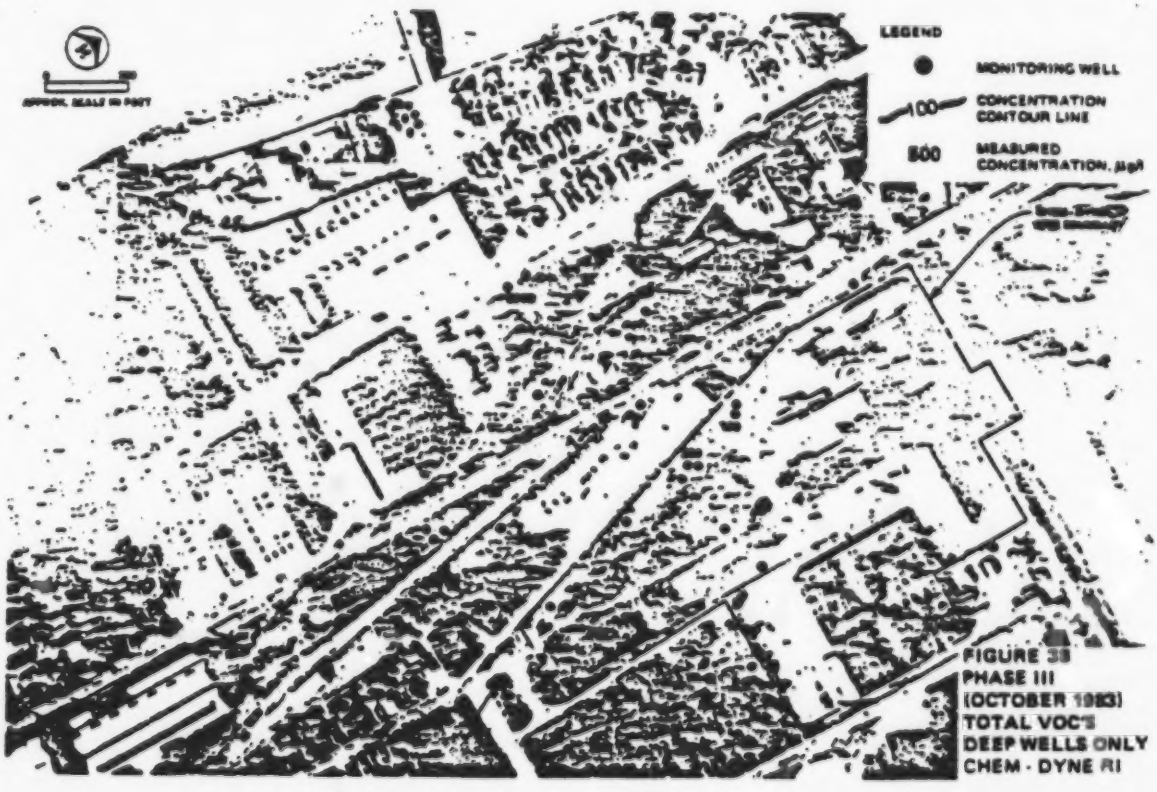

FIGURE 3B
PHASE III
(OCTOBER 1983)
TOTAL VOC'S
DEEP WELLS ONLY
CHEM - DYNE RI

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Table 2-7
SUMMARY OF GROUNDWATER CONTAMINATION AND CONSUMPTION CRITERIA--CASE 2

CARCINOGENS

		Hamilton Well Field		Future Well	
Fraction	Compound	Lifetime Average Dose (µg/kg bw/day)	Excess Lifetime Cancer Risk (10^{-6})	Lifetime Average Dose (µg/kg bw/day)	Estimated Lifetime Cancer Risk (10^{-6})
Base/Neutral	Hexachloroethane			0.030	0.4
	Benzo(a)pyrene			0.000016	0.2
Volatile	Benzene	0.0010	0.06	0.0053	0.3
	Carbon tetrachloride	0.00099	0.01	0.0054	0.7
	Chloroform	0.0055	0.4	0.022	2
	1,1-dichloroethene	0.00072	0.7	0.0029	3
	1,2-dichloroethane	0.0024	0.2	0.010	0.7
	Tetrachloroethene	0.0078	0.4	0.025	1
	1,1,2,2-tetrachloroethane	0.033	7	0.053	10
	Trichloroethene	0.023	0.3	0.10	1
	1,1,2-trichloroethane	0.039	2	0.077	4
	Vinyl chloride	0.0062	0.1	0.011	0.2
Pesticides/PCB	α-BHC			0.0000031	0.03
	β-BHC			0.00024	0.4
	γ-BHC			0.00092	1
	Chlordane	0.035	60	0.069	100
	4,4'-DDT			0.00089	7
	Dieldrin			0.000049	2
	Heptachlor	0.069	20	0.013	40
	PCB			0.000057	0.2
TOTAL			90		.200

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Table 1 (Page 1 of 2)
(FS Table 6-1)
SUMMARY OF EXAMPLE ASSEMBLED ALTERNATIVE NO. 1 (AA-1)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present[b] Worth
Soil			
Excavate a 10'-deep trench around the perimeter and remove soil; backfill with clay			
o Excavation and Backfilling	$80,000		$80,000
Excavate and remove 2' of soil on and offsite with 6' removal in Areas 9, 10, 11/12, and 13;			
o Excavation	1,800,000		1,800,000
o Transportation	2,200,000		2,200,000
o Disposal	2,900,000		2,900,000
Demolish and remove asphalt parking lot south of blue warehouse			
o Demolition and Soil Excavation	260,000		260,000
o Transportation	390,000		390,000
o Disposal	520,000		520,000
Cap and seal entire site with multilayer clay/membrane system	1,900,000	$17,000	2,100,000
Groundwater			
Extraction wells; groundwater removal till 10^{-6} cancer risk criteria are met	130,000	50,000	590,000[c]
Air stripping at 99 percent total VOC removal	1,500,000	16,000	1,600,000[d]
Off-gas scrubbing by carbon adsorption	1,800,000	460,000	3,600,000[d]
Facilities			
Demolish and remove all buildings and structures			
o Demolition	980,000		980,000
o Transportation	610,000		610,000
o Disposal	770,000		770,000
Demolish and remove concrete slab and loading dock			
o Demolition	76,000		76,000
o Transportation	150,000		150,000
o Disposal	190,000		190,000
Remove two open top onsite buried tanks	1,000		1,000
Seal all connections to northwestern storm sewer	10,000		10,000
Decontaminate and reline northwestern storm sewer segment	15,000		15,000

Table 1 (Page 2 of 2)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present Worth[b]
Facilities (continued)			
Clean 8" siphon and seal with grout	5,000		5,000
Rehabilitate existing storm sewer (southeast side) and decontaminate	97,000		97,000
Seal existing abandoned production wells with grout	10,000		10,000
Engineering			
Additional studies, design, construction management and inspection (does not include permitting costs)	4,100,000		4,100,000
Subtotal	16,400,000	$43,000	23,100,000
Contingency (@ 10%)	1,640,000	54,000	2,310,000
TOTAL	$18,000,000	$597,000	$25,400,000

[a] All cost estimates are Order-of-Magnitude level estimates, i.e., the cost estimates have an accuracy of +50 to -30 percent.
[b] Present worth based on 30-year period at 10 percent interest.
[c] Present worth based on 27-year period at 10 percent interest.
[d] Present worth based on 5-year period at 10 percent interest.

Table 2 (Page 1 of 2)
(FS Table 6-2)
SUMMARY OF EXAMPLE ASSEMBLED ALTERNATIVE NO. 2 (AA-2)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present[b] Worth
Soil			
Excavate and remove 3' of soil; on and offsite;			
o Excavation	$1,600,000		$1,600,000
o Transportation	1,900,000		1,900,000
o Disposal	2,500,000		2,500,000
Demolish and remove asphalt parking lot south of blue warehouse			
o Demolition and Soil Excavation	260,000		260,000
o Transportation	390,000		390,000
o Disposal	520,000		520,000
Cap and seal entire site with multilayer clay/membrane system	1,900,000	$17,000	2,100,000
Groundwater			
Extraction wells; groundwater removal to detection limits	130,000	50,000	630,000[c]
Air stripping at 90 percent total VOC removal	400,000	3,200	410,000[d]
Off-gas scrubbing by carbon adsorption	1,100,000	230,000	2,000,000[d]
Facilities			
Demolish and remove all buildings and structures			
o Demolition	980,000		980,000
o Transportation	610,000		610,000
o Disposal	770,000		770,000
Demolish and remove concrete slab and loading dock			
o Demolition	76,000		76,000
o Transportation	150,000		150,000
o Disposal	190,000		190,000
Remove two open top onsite buried tanks	1,000		1,000
Seal all connections to northwestern storm sewer	10,000		10,000
Decontaminate and reline northwestern storm sewer segment	15,000		15,000
Clean 8" siphon and seal with grout	5,000		5,000
Rehabilitate existing storm sewer (southeast side) and decontaminate	97,000		97,000
Seal existing onsite abandoned production wells with grout	10,000		10,000

Table 2 (Page 2 of 2)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present[b] Worth
Engineering			
Additional studies, design, construction management and inspection (does not include permitting costs)	3,400,000	———	3,400,000
Subtotals	17,000,000	320,000	18,600,000
Contingency (at 10%)	1,700,000	32,000	1,900,000
TOTAL	$18,700,000	$350,000	$20,500,000

[a] ... cost estimates are Order-of-Magnitude level estimates, i.e., the cost estimates have an accuracy of +50 to -30 percent.
[b] Present worth based on 30-year period at 10 percent interest.
[c] Present worth based on 950-year period at 10 percent interest.
[d] Present worth based on 5-year period at 10 percent interest.

Table 3 (Page 1 of 2)
(FS Table 6-3)
SUMMARY OF EXAMPLE ASSEMBLED ALTERNATIVE NO. 3 (AA-3)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present Worth[b]
Soil			
Excavate and remove 2' of soil on and offsite;			
• Excavation	$1,100,000		$1,100,000
• Transportation	1,300,000		1,300,000
• Disposal	1,700,000		1,700,000
Cap and seal areas of soil and concrete slab removal with loam over clay system	980,000	$11,000	1,100,000
Remove asphalt parking lot south of blue warehouse; excavate and remove 2' of soil; backfill and repave; replace guardrails and catch basin			
• Demolition and Excavation	260,000		260,000
• Transportation	390,000		390,000
• Disposal	520,000		520,000
• Repaving and Backfilling	110,000	2,000	130,000
• Replace guardrails and catchbasins	10,000		10,000
Groundwater			
Extraction wells; groundwater removal until 10^{-6} cancer risk criteria are met	130,000	50,000	590,000[c]
Air stripping at 70 percent total VOC removal	130,000	1,000	130,000[d]
Off-gas scrubbing by carbon adsorption	620,000	140,000	1,200,000[d]
Facilities			
Demolish and remove Chem-Dyne, garage and boiler buildings; backfill and cap and seal with loam over clay			
• Demolish	180,000		180,000
• Transportation	100,000		100,000
• Disposal	170,000		170,000
• Backfill	58,000		58,000
Demolish and remove concrete coal bin; cap and seal with loam over clay			
• Demolish	24,000		24,000
• Transportation	45,000		45,000
• Disposal	60,000		60,000
Demolish and remove concrete slab and loading dock			
• Demolish	76,000		76,000
• Transportation	150,000		150,000
• Disposal	190,000		190,000
Decontaminate Ford, Ward and blue warehouse buildings	420,000		420,000
Remove two open top onsite buried tanks	1,000		1,000
Seal all connections to northwestern storm sewer segment	10,000		10,000
Decontaminate and reline northwestern storm sewer segment	15,000		15,000

Table 3 (Page 2 of 2)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present Worth[b]
Clean 8" siphon and seal with grout	5,000		5,000
Rehabilitate existing storm sewer (southeast side) and decontaminate	97,000		97,000
Seal existing abandoned production wells with grout	10,000		10,000
Engineering			
Additional studies, design, construction management and inspection (does not include permitting costs)	2,200,000		2,500,000
Subtotals	11,100,000	200,000	12,600,000
Contingency (at 10%)	1,100,000	20,000	1,300,000
TOTAL	$12,200,000	$220,000	$13,900,000

[a] All cost estimates are Order-of-Magnitude level estimates, i.e., the cost estimates have an accuracy of +50 to -30 percent.
[b] Present worth based on 30-year period at 10 percent interest.
[c] Present worth based on 27-year period at 10 percent interest.
[d] Present worth based on 5-year period at 10 percent interest.

Table 4 (Page 1 of 2)
(FS Table 6-4(
SUMMARY OF EXAMPLE ASSEMBLED ALTERNATIVE NO. 4 (AA-4)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present[b] Worth
Soil			
Excavate and remove hotspots	*[c]	*[c]	*[c]
Demolish and remove asphalt parking lot south of blue warehouse			
o Demolition	$12,000		$12,000
o Transporation	49,000		49,000
o Disposal	65,000		65,000
Cap and seal entire site with multilayer clay/membrane system	1,900,000	$17,000	2,100,000
Groundwater			
Extraction wells; groundwater removal until 10^{-6} cancer risk criteria are met	130,000	50,000	590,000[d]
Air stripping at 99 percent total VOC removal	1,300,000	16,000	1,600,000[e]
Off-gas scrubbing by carbon adsorption	1,800,000	460,000	1,600,000[e]
Facilities			
Demolish and remove all buildings and structures			
o Demolition	980,000		980,000
o Transportation	610,000		610,000
o Disposal	770,000		770,000
Demolish and remove concrete slab and loading dock			
o Demolition	76,000		76,000
o Transportation	150,000		150,000
o Disposal	190,000		190,000
Remove two open top onsite buried tanks	1,000		1,000
Seal all connections to northwestern storm sewer	10,000		10,000
Decontaminate and reline northwestern storm sewer segment	15,000		15,000
Clean 8" siphon and seal with grout	5,000		5,000
Rehabilitate existing storm sewer (southeast side) and decontaminate	97,000		97,000
Seal existing abandoned production wells with grout	10,000		10,000

Table 4 (Page 2 of 2)

Remedial Action	Cost Estimates[a] Capital	Annual Operation & Maintenance	Present[b] Worth
Engineering			
Additional studies, design, construction management and inspection (does not include permitting costs)	2,100,000		2,700,000
Subtotals	10,500,000	$43,000	13,700,000
Contingency (at 10%)	1,100,000	54,000	1,400,000
TOTAL	$11,600,000	$597,000	$15,100,000

[a] All cost estimates are Order-of-Magnitude level estimates, i.e., the cost estimates have an accuracy of +50 to -30 percent.
[b] Present worth based on 30-year period at 10 percent interest.
[c] The quantity of hotspot soil removal will be determined by sampling prior to and during implementation therefore costs for this action are not presented.
[d] Present worth based on 27-year period at 10 percent interest.
[e] Present worth based on 5-year period at 10 percent interest.

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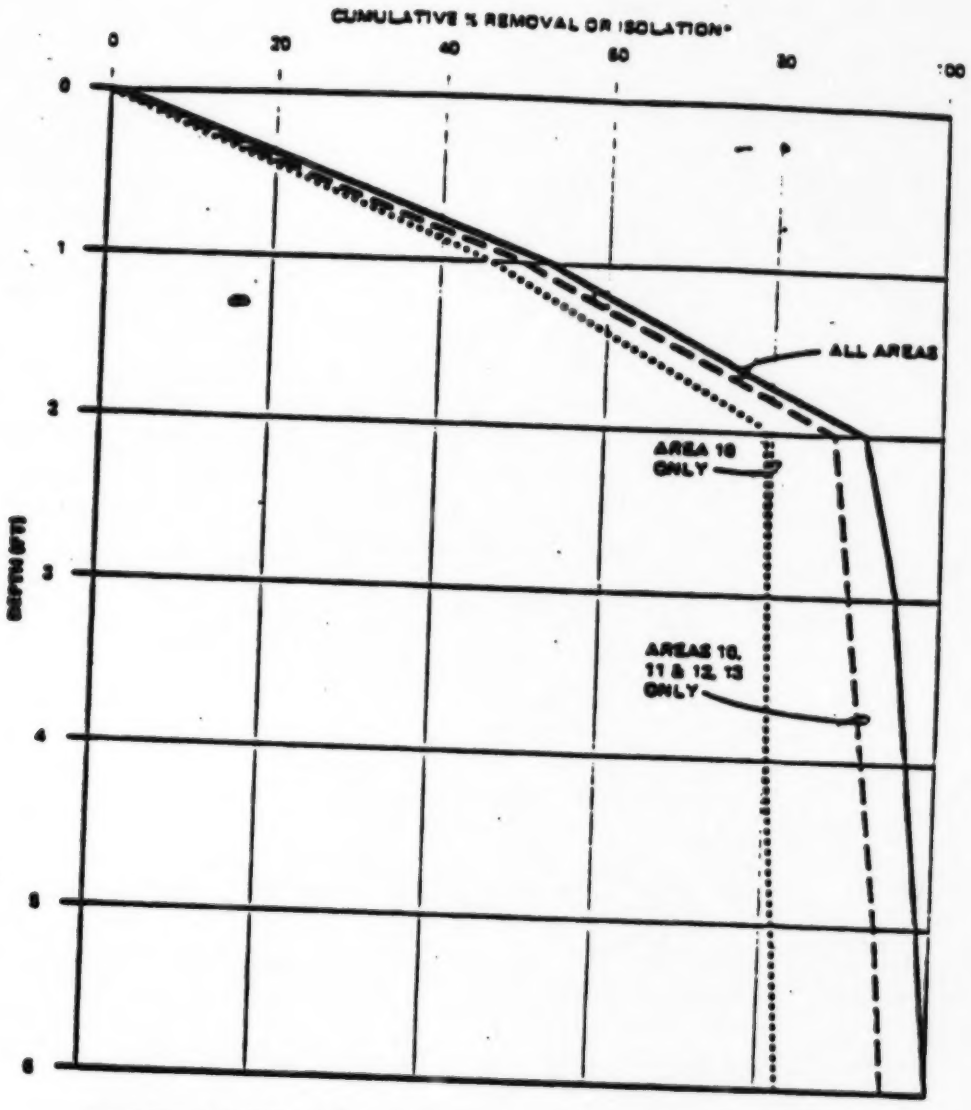

*100% removal of VOC's and S/N within top 6 feet is approximately 9,250,000 grams.

NOTE: See Figure 5-1 for delineation of soil areas

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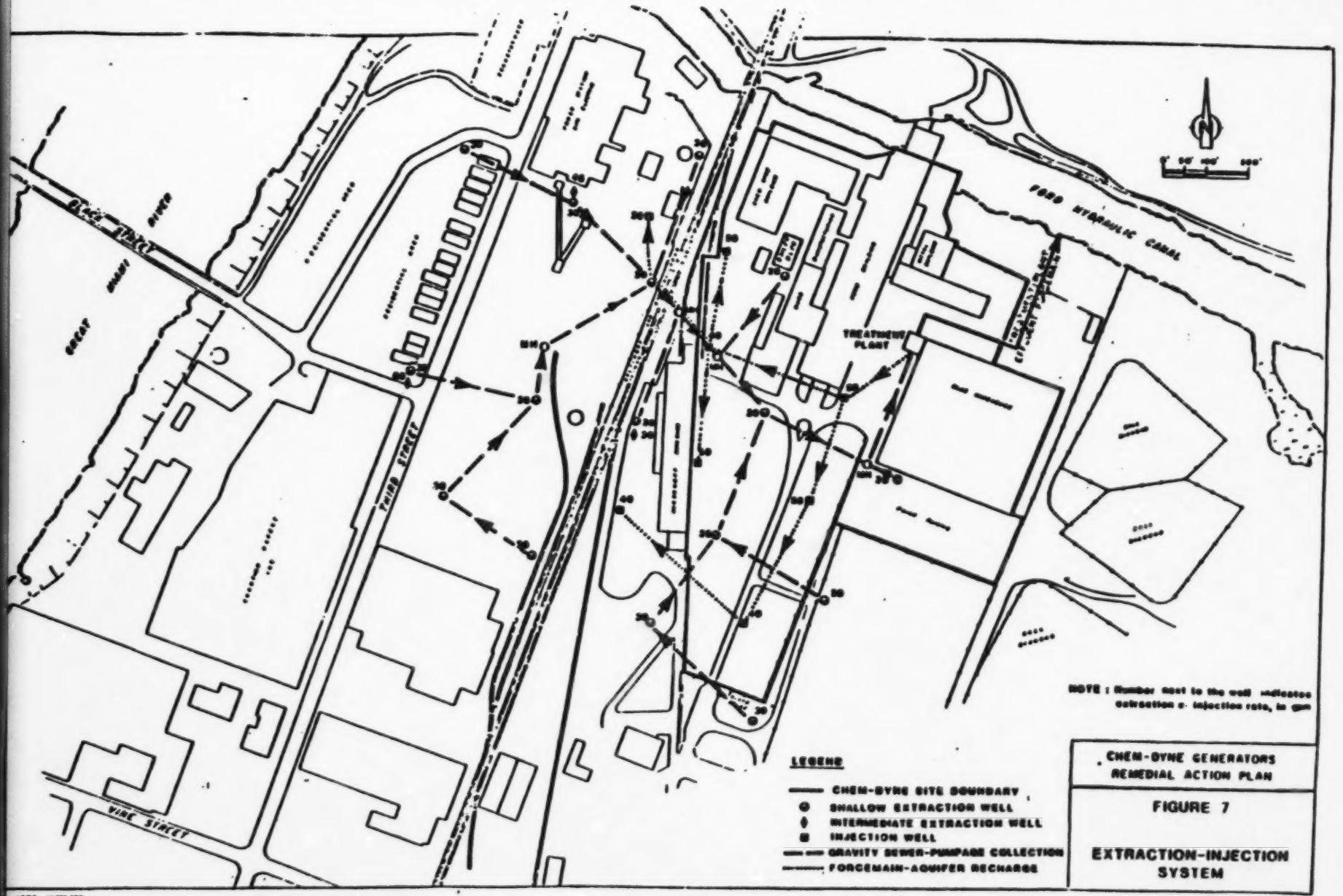
FIGURE 5-2
SOIL CONTAMINATION DISTRIBUTIONS
CHEM - DYNE FS


FORD HYDRAULIC CANAL
TREATMENT PLANT
THIRD STREET
VINE STREET
NOTE : Number next to the well indicates extraction or injection rate, in gpm
LEGEND
CHEM-DYNE SITE BOUNDARY
SHALLOW EXTRACTION WELL
INTERMEDIATE EXTRACTION WELL
INJECTION WELL
GRAVITY SEWER-PUMPAGE COLLECTION
FORCEMAIN-AQUIFER RECHARGE
CHEM-DYNE GENERATORS
REMEDIAL ACTION PLAN
FIGURE 7
EXTRACTION-INJECTION SYSTEM

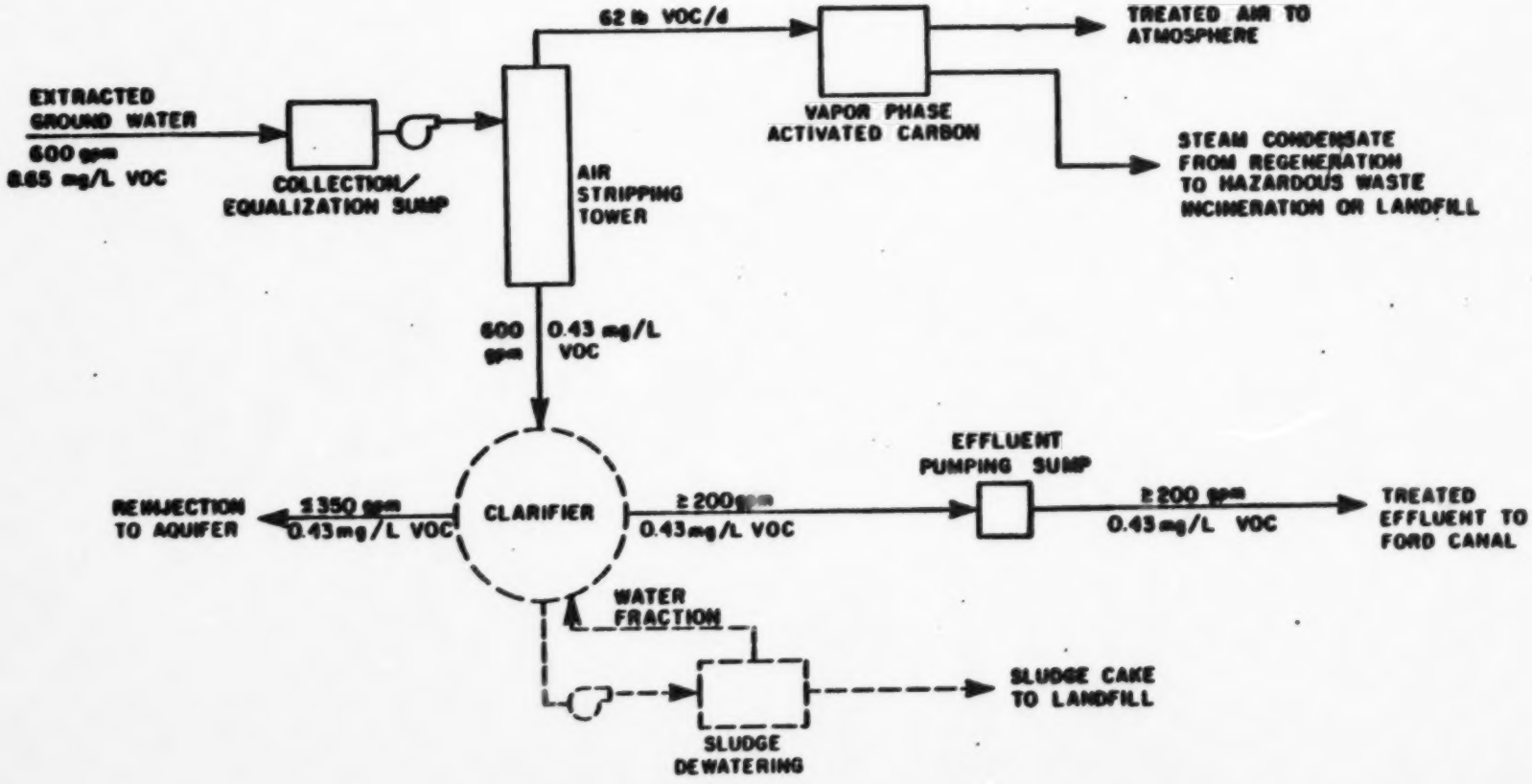


figure 10

SCHEMATIC FLOW DIAGRAM
GROUNDWATER TREATMENT PROCESS
CHEM-DYNE GENERATORS
REMEDIAL ACTION PLAN
Chem-Dyne Site

1484 - 11/01/88

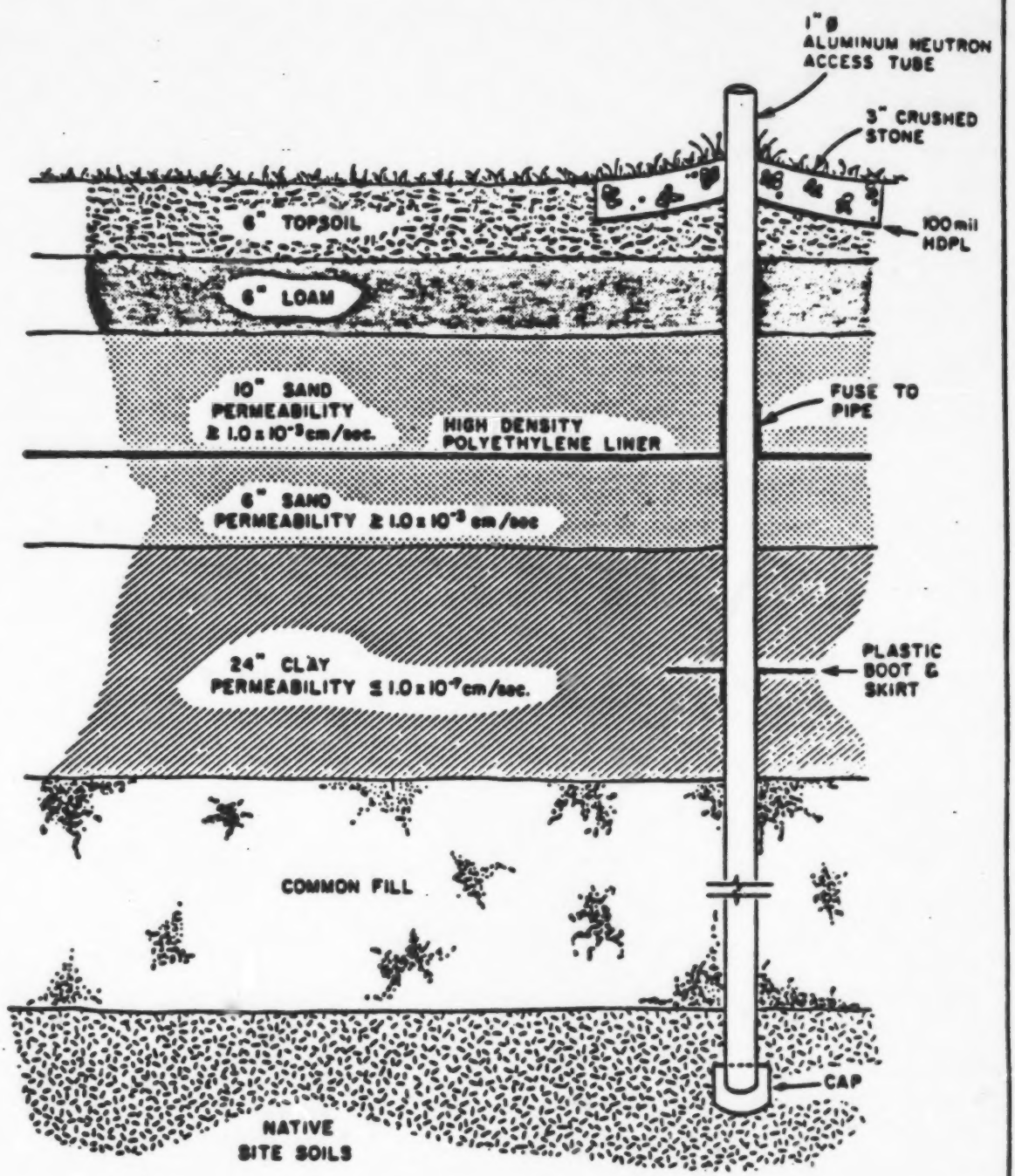


figure II

COMPOSITE CAP CONSTRUCTION
CHEM-DYNE GENERATORS
REMEDIAL ACTION PLAN
Chem-Dyne Site